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THIN FILM DEPOSITION SYSTEM

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(54) [Title of Invention] Thin Film Deposition System

(57) [Abstract]

[Purpose] To obtain a thin film deposition system for with a high

vaporization efficiency for vapor deposition materials.

[Constitution] The area of contact between the vapor deposition material and the crucible was increased by such means as making multiple apertures in the crucible to hold the vapor deposition material and installing fins in the crucible. This resulted in the improved transmission of heat to the vapor deposition material and, hence, uniform heating.

1: crucible

2: vapor deposition material

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[Scope of Claims]

[Claim 1] A thin film deposition system where a crucible containing the vapor deposition material is heated, the aforementioned vapor deposition material is vaporized, and the vaporized deposition material is deposited on the object to be coated to form a thin film, which system is characterized by the multiple apertures made in the aforementioned crucible to hold the aforementioned vapor deposition material.

[Claim 2] A thin film deposition system where a crucible containing the vapor deposition material is heated, the aforementioned vapor deposition material is vaporized, and the vaporized deposition material is deposited on the object to be coated to form a thin film, which system is characterized by the installation of fins on the

inner wall of the aforementioned crucible.

[Detailed Description of Invention]

[0001]

[Field of Industrial Application] This invention relates to thin film deposition systems for forming thin films, particularly thin film deposition systems employing the ion cluster beam method (ICB method) for forming high performance thin films.

[0002[

[Prior Art] Figure 4, for example, is a sectional view of the traditional thin film deposition system shown in Kokoku Patent Gazette 1979-9592, where 1 in the Figure is a crucible containing vapor deposition material 2, 3 is the lid of the crucible, and 4 are multiple aperture-like nozzles are on the lid. 5 is a coiled heating filament for heating the crucible 1 located on the outside of the crucible. 6 is a heat shield panel surrounding the crucible 1 and the heating filament 5, with openings in locations corresponding to the nozzles and the same electrical potential as the heating filament.

[0003] 8 is a cylindrical metal grid located above the heat shield panel 6 in the Figure, 9 is a ring shaped ionization filament placed around the grid 8, 10 is a grid electrode connected to the grid 8, 11 is an acceleration electrode located above the grid electrode 10, 12 located above the acceleration electrode is the board to be

coated by vapor deposition , and 13 is a vacuum chamber for holding 1 to 12 above and maintaining the interior of the chamber a vacuum.

[0004] 15 is the first AC source for providing power to the heating filament 5, 16 is the first DC power source for maintaining the electropositive potential of the crucible 1 to counter the heating filament 5, 17 is the second AC source for supplying power to the ionization filament 9, 19 is the second DC power source for maintaining the electropositive potential of the grid to counter the ionization filament 9, and 19 is the third DC power source for maintaining the electronegative potential of the acceleration electrode to counter the crucible 1.

[0005] A description of the operation follows. The heating filament 5 is heated by the first AC power supply 15 and emits thermal electrons. Because the electric potential of the crucible 1 is positive as opposed to the heating filament 5, the thermal electrons flow toward the crucible 1 at an accelerated speed and crash into the walls 1A, heating it. As a result, the vapor deposition material 2 inside the crucible is heated, vaporizes, and blows out into the vacuum in the upper section of the figure. A part of the vaporized deposition material forms a cluster.

[0006] Figure 3 is a section view showing the crucible 1 and the vapor deposition material 2 contained therein. The transmission of heat to the vapor deposition material 2 takes place only via the

portion in contact with the walls 1A of the crucible 1. If the vapor deposition material is of a nature that sublimes, even if the crucible is initially filled with the material to where it will be in contact with the walls 1A of the crucible 1 as shown in (A) of he Figure, the portion of the material in contact with the walls 1A sublimes first as shown in (b) of the Figure, forming a gap between the walls 1A and the vapor deposition material. As a result, thermal conduction of the remaining vapor deposition material declines.

[0007] Going back to Figure 4, electrons emitted by the ionization filament 9 heated by he second AC power source are attracted by the grid 8 and pass through the grid, crashing into the vaporized 21 deposition material 2. Electrons are knocked out of the vapor, and the vapor becomes positively charged ions. These positive ions are accelerated upwards in Figure 2 by the accelerating electrode 11 and head toward the board 12, depositing themselves thereon and forming a thin film 22.

[0008]

[Problem to Be Solved by Invention] Because the traditional thin film depositing system is constituted as explained above, the area of contact between the vapor deposition material and the crucible is small and, therefore, heat is not transmitted well from the crucible to the material, and the material is not evenly heated. The intent of this invention is to eliminate such problems as the

foregoing, and the purpose is to create a thin film deposition system with a high vapor deposition material vaporization efficiency.

[0009]

[Problem to Be Solved by Invention] The thin film deposition system pertaining to this invention involves making multiple apertures on the inside of the crucible to hold vapor deposition materials. Further, fins are installed on the inner walls of the crucible.

[0010]

[Effect] Because the area of contact between the vapor deposition material and the crucible is large in the thin film deposition system pertaining to this invention, heat is transmitted well from the crucible to the material, and the material is evenly heated.

[0011]

[Embodiment] Following is an explanation of the drawing of an embodiment of this invention. Figure 1 is a perspective view of a crucible embodying the thin film deposition system pertaining to this invention. Since the overall constitution other than the crucible and the operation are the same as for Figure 4, an explanation thereon is omitted. Since 1A, 3, and 4 in Figure 1 are also the same as in Figure, explanation thereon is also omitted. 1 is a crucible for holding vapor deposition materials, and 23 are multiple cylindrical apertures with an opening on the top.

[0012] A description of the operation follows. \as shown in Figure

3 (C), each aperture 23 is filled with a vapor deposition material 2 and heat is applied via the walls 1A of the crucible 1. The heat passes through areas 1B without the apertures 23, reaches the apertures 23, and heats the vapor deposition material 2. Because the area of contact between the vapor deposition material and the crucible is large, heat is transmitted well and the vapor deposition

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material is heated evenly. In the event the vapor deposition material is of a nature that sublimes, a gap 7 will from between the vapor deposition material 2 and the crucible 1 as the vaporization of the material progresses. However, since the aforementioned area of contact is large, the amount of the vapor deposition material that remains in the center of the apertures 23 is small, as shown in Figure 3 (D).

[0013] Figure 2 is a perspective view of another crucible embodying the thin film deposition system pertaining to this invention. 24 are multiple fins installed on the inner walls of crucible 1; that is, on the inner side of the walls 1A. Because the area of contact between the vapor deposition material and the crucible 1 is large also in this embodiment, it has the same effect as the embodiment shown in Figure 1.

[0014] While the aforementioned embodiments are capable of ionizing and accelerating the vaporized deposition material 2, the

invention may be applied also to systems without said functions.

[0015]

[Effect of Invention] As explained above, this invention involves making multiple apertures in the crucible for holding vapor deposition materials, as well as installing fins in the crucible, and is constituted to increase the area of contact between the vapor deposition material and the crucible, thereby improving the transmission of heat to the vapor deposition material, and to heat the vapor deposition material evenly, thereby increasing the vaporization efficiency of the material.

[Brief Description of Drawings]

[Figure 1] This is a perspective view of a crucible of a thin film deposition system embodying this invention.

[Figure 2] This is a perspective view of a crucible of another thin film deposition system embodying this invention.

[Figure 3] This is a section view of a crucible and a vapor deposition material therein.

[Figure 4] This is a section view of a traditional thin film deposition system.

[Explanation of Codes]

1 crucible

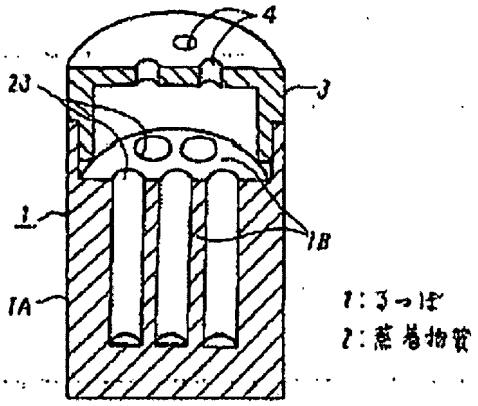
2 vapor deposition material

12 board

22 thin film

Figure 1

【図1】



1: crucible

2: vapor deposition material

Figure 2

【図2】

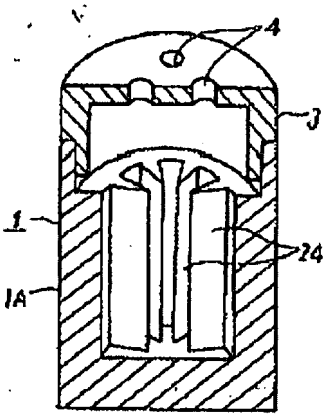


Figure 3

【図3】

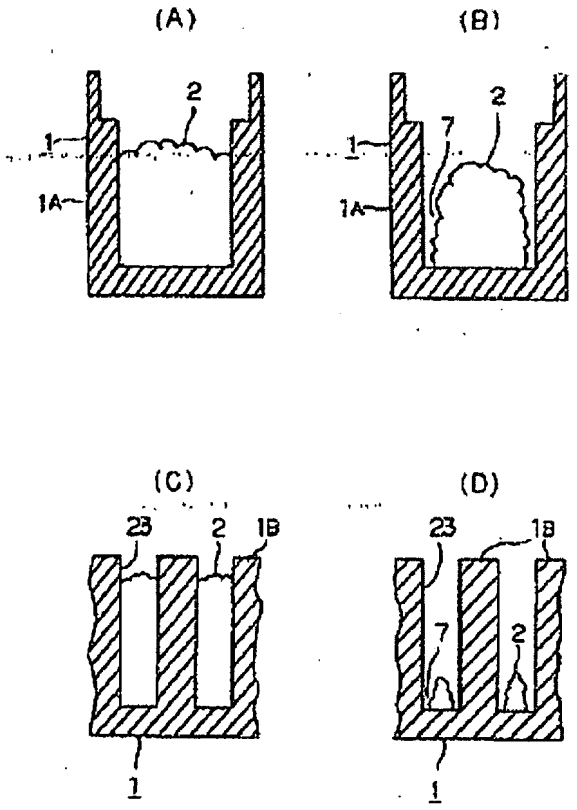
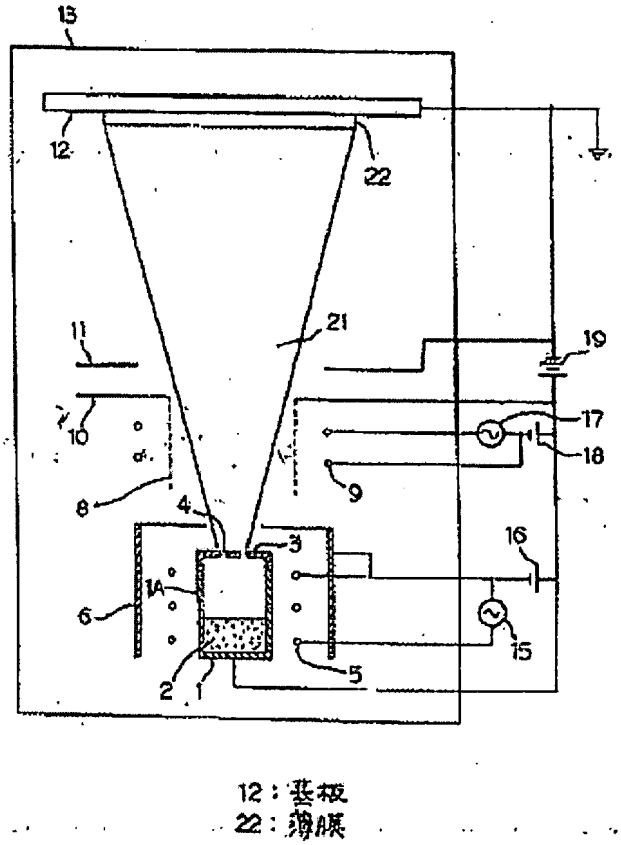


Figure 4

【図4】



12 board

22 thin film